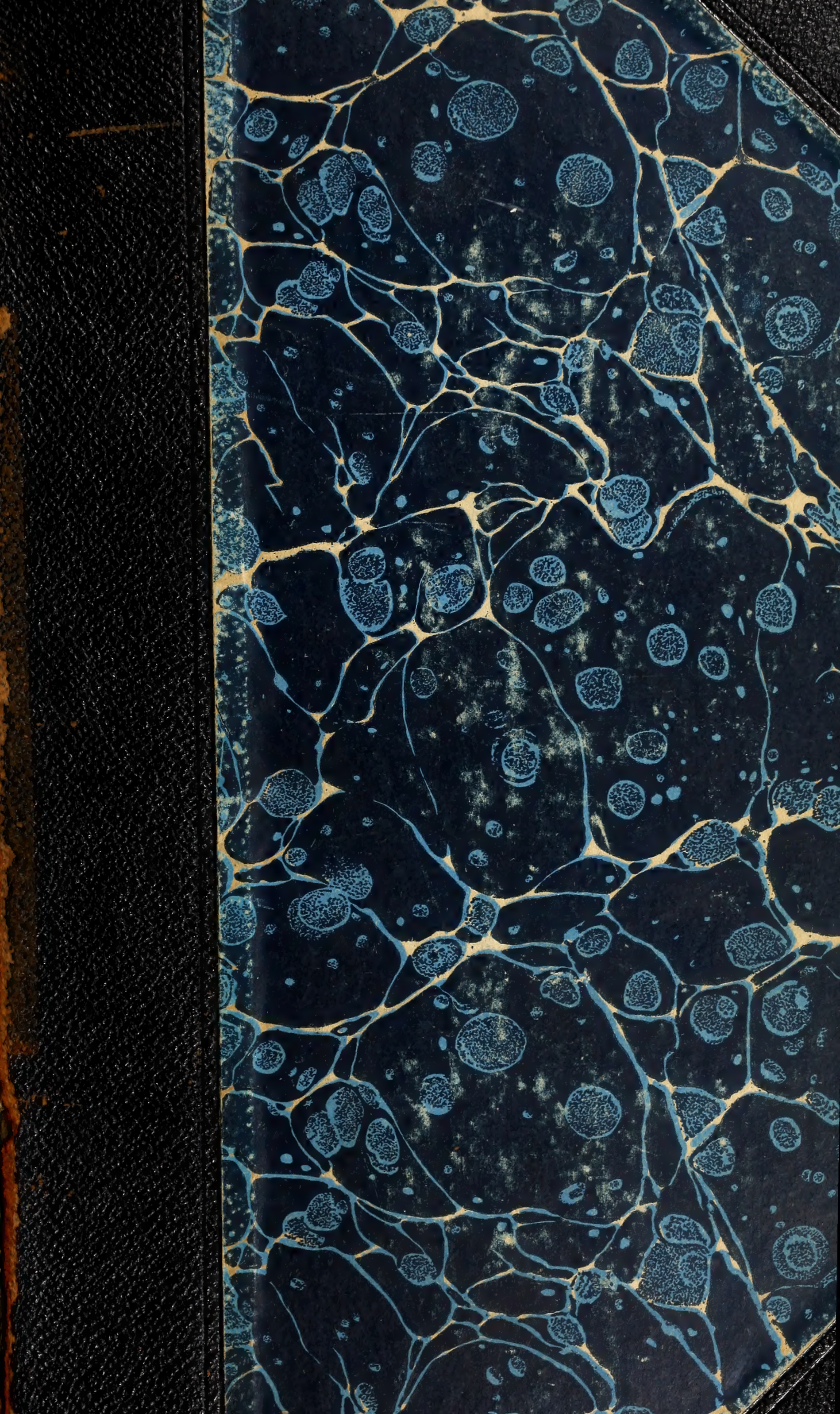

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L. O. HOWARD, Chief

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BIONOMICS OF THE CHINCH BUG.

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INTRODUCTION.

During several years past the biology of the chinch bug (*Blissus leucopterus* Say) has been studied in South Carolina with a view to the control of the insect in that region. It is a pest of considerable importance, especially in some of the northern counties of the State. Many planters in this region will plant no grain, giving as a reason that attempts to grow grain result in producing chinch bugs, and as a consequence they are unable to make a corn crop. Coincident with the conduct of field investigations, some time was devoted to a study of the insect in the laboratory at Columbia, and although this work is not complete, certain novel facts regarding the life history of the pest have been learned which make it advisable to publish immediately the information thus obtained. Wherever the chinch bug has been treated in the literature, it has always been represented as passing through five instars in its development. By means of the experiments conducted at Columbia, S. C., it has been shown that in this locality the insect has six instars, instead of five, exclusive of the egg stage, viz, five immature stages, the sixth being the adult stage. The figures of the stages of this insect given by C. V. Riley, which have been used over and over again in various bulletins and other works on this subject, therefore are incorrect, at least in so far as South Carolina is concerned. Specimens of the different stages were preserved at Columbia, and from these drawings have been made by

Miss E. H. Hart, to whom much credit is due. A dipterous parasite of the adult insect has also been reared for the first time, as described below.

SEASONAL HISTORY IN SOUTH CAROLINA.

NUMBER OF GENERATIONS.

There are two generations of the chinch bug annually in the South, the same as in the North. The adults begin to mate shortly after they emerge from hibernation quarters, this emergence occurring during the latter part of April, as mentioned elsewhere in this paper. A few pairs in copula, however, have been collected prior to this date. General copulation does not occur until after the spring migration, or after the adults have reached their feeding ground; it usually takes place during the first week in May, although the time varies somewhat. Eggs are deposited shortly after, and by the latter part of May nymphs appear. By the end of the first week in June the majority of the old adults are dead and by the middle of the same month new adults begin to appear, although not attaining their maximum abundance until some time in July. Part of June, July, and part of August are covered by the second generation, which may be called the summer generation. The adults from this generation appear in September and October, and some probably in early November, and go into hibernation for the winter. The two generations overlap to such an extent that during the summer months all stages of the insect may be found in the fields at once.

HIBERNATION.

In the South this insect passes the winter in the adult stage among old, dead cornstalks, especially under their leaf sheaths and in their husks. There is no doubt that many individuals also hibernate among dead grass, along terraces and borders of fields. They are not found in any great numbers in any one place during this season of the year, but are fairly well scattered, so much so that it is a difficult matter to find any quantity of them at any one time. The bugs apparently feed but little during winter but remain hidden until the warm spring sun arouses them to activity and they prepare for their spring migration.

DISSEMINATION.

This insect migrates from its winter quarters to grain fields principally by flight. The adults of the hibernating generation apparently consist exclusively of winged forms and are fully capable of spreading into fields of forage and grain. Thus far no short-winged individuals have been found among the spring migrants. The exact time when migration takes place in spring has not been definitely determined, but apparently it is during the month of April. Migration is governed largely by seasonal conditions. The phenomenon of migration in this insect in spring on such an extended scale is a topic for general conversation among the planters in regions subject to infestation. The planters state that during migration the bugs fill the air like swarms of bees and are even known to enter dwellings at night. To a lesser extent the adults spread on foot to grain fields from their winter quarters, especially when such fields are not far removed from where the bugs have hibernated. It is not an uncommon practice in the South to sow grain, especially winter oats, on corn stubble land, and in such cases the adults find their food without having to search for it. There does not appear to be any definite summer migration. This may be due partly to the fact that a large number of the individuals of the summer generation are short-winged forms, unable to fly, and hence are compelled to seek fresh fields by crawling to them.

BEHAVIOR.

Adult chinch bugs often feign death when disturbed, especially when they happen to be lying on their backs. When it is least expected, however, they will right themselves quickly and scamper away to seek concealment under the nearest shelter, and are then difficult to capture. They are exceedingly quick on their feet, and when a vial, in which they are held captive, is opened, are often able to regain their freedom before the observer realizes what has happened. When adults are captured in the field they frequently escape by crawling through the little spaces between one's fingers and quickly drop to the ground. The nymphs of all stages are quite as active as the adults and often escape from captivity in a similar manner. Activity, of course, depends upon prevailing temperatures. Early in the morning the adults and nymphs are often quite sluggish and are easily taken, but by the middle of the day they become exceedingly active.

This insect is a sociable creature, both in its nymphal and adult stages, and when a number of individuals are placed in the same cage they will be found, later on, feeding in a little group. When disturbed they scamper in all directions, to reassemble when danger has passed. Upon removal of the lid from a tin ointment box used as an incubation cage the nymphs that had hatched were often found huddled closely together in a little group along the edge on the underside of the lid, these nymphs being very small when newly emerged.

MATING.

Mating takes place repeatedly among the individuals of this species, and may occur at intervals of from 5 to 8 days. The adults remain in copula for some time, occasionally for 12 hours or more, and during this time are easily captured. During copulation the female alone remains active, traveling about frequently, and dragging the male helplessly after her. There is little doubt that there are both polyandry and polygamy among the adults of the chinch bug, since they mate an indefinite number of times.

LIFE HISTORY OF THE CHINCH BUG.

OVIPOSITION.

Under field conditions eggs are placed by the female near or on the plants upon which the insect feeds. Eggs may be found in the soil near the roots, at the base of the plants, but more often occur in the leaf sheath, which appears to be the preferred place.

In the laboratory bacteriological test tubes, of standard size, stoppered with absorbent cotton and supplied with parts of corn plants, were found to be the most successful type of egg cage. The corn plants used as hosts were about 6 inches high, with their foliage and the outer roots cut off before introduction into the cage. Sometimes parts of larger cornstalks were used when young corn was not available. In cages where young corn was supplied the eggs were laid on all parts of the plant, but most frequently were placed under the upper epidermal layer of the leaf sheath. This appears to be their favorite location, although many eggs were placed in the cotton stopper of the vial. Where parts of cornstalks were used, the eggs were often found pushed into the pith, on either end, to their entire depth, sometimes two and three together. In the leaf sheaths they are often found in quantities, side by side. In one instance 16 eggs were found placed in this manner in a neat, compact row. With a little care the whole row was lifted out without any of the eggs becoming detached. It was not often that eggs were placed loosely in the vials. It seems that the female desires to conceal her eggs from possible predacious enemies.

Eggs in cages were deposited during all hours of the day. It is possible that some may be deposited during the night, but this is doubtful. In the field it is quite likely that very few eggs are deposited during early morning hours, the temperature at that time of the day being lower and damp, which causes the adults to become numb and therefore sluggish.

NUMBER OF EGGS DEPOSITED BY A SINGLE INDIVIDUAL.

Considerable variation has been noted in the number of eggs deposited by an individual female of this species. Such variation undoubtedly is governed to some extent by seasonal weather conditions. There is no doubt, however, that some females are by nature more fecund than others.

Females and males, taken in copula in the field very early in spring, were placed in test tubes and counts made of the number of eggs laid. Data relating to four of these cages are given in Table I. The largest number of eggs deposited in any one of the four cages was 119, in cage 20–51. The smallest number, 51, was obtained in cage 20–53. The average number deposited by one female, based on the four individuals, is 85.25 eggs. Oviposition extended over a period of 56 egg-laying days in cage 20–50, and only 41 days in cage 20–51, although more eggs were deposited in the former cage than in the latter.

Although the individuals were collected from the field, there does not seem to be much doubt that the females had begun to oviposit before they were captured, since they were taken at the time of their migration and shortly afterwards, and at the time when they were copulating in great numbers.

TABLE 1.—*Records of daily and total egg production of four individuals of Blissus leucopterus, Columbia, S. C., 1920.*

Cage No. 20–50.		Cage No. 20–51.		Cage No. 20–53.		Cage No. 20–55.	
Date of oviposition.	Number of eggs.	Date of oviposition.	Number of eggs.	Date of oviposition.	Number of eggs.	Date of oviposition.	Number of eggs.
May 11	1	May 8	1	May 9	......	May 9	......
May 12–26	......	May 9–25	......	May 10	12	May 10	6
May 27	2	May 26	6	May 11	......	May 11	......
May 28–31	......	May 27–28	......	May 12	3	May 12	......
June 1	2	May 29	2	May 13	1	May 13	2
June 2	1	May 30–31	9	May 14	2	May 14–24	......
June 3	2	June 1	2	May 15–20	......	May 25	6
June 4	3	June 2	5	May 21	3	May 26	......
June 5	1	June 3	10	May 22–24	10	May 27	3
June 6–7	3	June 4	4	May 25	4	May 28	6
June 8–9	2	June 5	5	May 26	2	May 29	10
June 10	4	June 6–7	14	May 27	6	May 30–31	6
June 11	6	June 8–9	10	May 28	3	June 1	4
June 12	......	June 10	2	May 29	5	June 2	13
June 13–14	14	June 11	5			June 3	6
June 15	2	June 12	3			June 4	10
June 16	7	June 13–14	23			June 5—Female dead; dissected.	3
June 17–18	10	June 15	11				
June 19	3	June 16	5				
June 20–21	12	June 17–18	2				
June 22–23	7						
June 24	2						
June 25–26	3						
June 27–29	......						
June 30	1						
July 1–6	7						
Total	95	Total	119	Total	51	Total	75

LENGTH OF THE EGG STAGE.

The length of the incubation period is governed primarily by prevailing temperature. During early spring it may be slightly more than a month and during midsummer a trifle more than a week. In the laboratory at Columbia, S. C., a record on the incubation period of 664 eggs was obtained during the spring and summer of 1919 and 1920. These data are given in Table 2. The longest period obtained for the egg stage was 31 days. This egg hatched on June 8 from a lot of 103 deposited on May 8. The shortest egg period was 9 days, during July. There is a gradual decrease in the length of the egg stage from early May to July, and during August it again increases.

Not all of the eggs of one day's deposition hatch on the same day, although the reason for this is not definitely known. It may be that some eggs are not sufficiently supplied with moisture, or with the same amount that the others receive, and consequently develop more slowly. There may be a difference of nine days in the time of hatching in the same lot of eggs, as will be noted in Table 2 under entry of May 8. The greater number of this lot of 103 eggs, however, hatched within 3 days after hatching began. The first eggs in this lot hatched on May 31, the last on June 8. There is a greater range in the time of hatching in a single lot of eggs in the early spring months than in the summer months. In the latter period a lot of eggs laid on the same day generally hatch within at most 3 days after hatching has begun, and quite often all of them hatch on the same day.

The weighted average for the egg period of the 664 eggs recorded in Table 2 is 21.96+ days.

The type of cage used for observation purposes on the incubation period consisted of a very small tin ointment box with a plaster of paris bottom. The porous qualities of this substance permitted introduction of just the right amount of moisture. No great difficulty was experienced with fungus, which often develops in closed boxes where moisture is present, especially when used continuously for as long a time as in these experiments. This type of egg cage has been found exceedingly satisfactory for making observations on the egg stages of various insects, especially those which lay their eggs in the soil or other damp places, and therefore have to be kept fairly moist if good results are to be obtained. It was devised in connection with investigations of the southern corn rootworm (*Diabrotica 12-punctata* Oliv.).

TABLE 2.—*Length of incubation period of eggs of Blissus leucopterus. Columbia, S. C., 1919–20.*

Eggs deposited.		Eggs hatched.		Length of egg stage.
Date.	Number.	Date.	Number.	
				Days.
May 4	3	May 29	3	25
May 6	6	May 31	1	25
		June 1	3	26
		June 2	2	27
May 8	103	May 31	12	23
		June 1	43	24
		June 2	40	25
		June 3	2	26
		June 4	1	27
		June 5	2	28
		June 6	2	29
		June 7	......	....
		June 8	1	31
May 9	9	June 2	6	24
		June 3	3	25
May 10	37	June 2	19	23
		June 3	14	24
		June 4	2	25
		June 6	......	....
		June 6	2	26
May 11	21	June 2	3	22
		June 3	11	23
		June 4	5	24
		June 5	......	....
		June 6	2	26
May 12	48	June 3	4	22
		June 4	28	23
		June 5	11	24
		June 6	5	25
May 13	39	June 3	1	21
		June 4	8	22
		June 5	12	23
		June 6	18	24
May 17	66	June 6	14	20
		June 7	39	21
		June 8	13	22
May 18	2	June 9	1	22
		June 10	1	23
May 19	12	June 7	12	19
May 21	3	June 12	3	22
May 22	2	June 12	2	21
May 25	58	June 14	18	20
		June 15	39	21
		June 16	1	22
May 26	22	June 14	6	19
		June 15	16	20
May 27	27	June 14	1	18
		June 15	23	19
		June 16	3	20
May 28	18	June 15	14	18
		June 16	4	19
May 29	23	June 15	1	17
		June 16	22	18
June 1	11	June 16	2	15
June 1		June 17	8	16
		June 18	1	17
June 2	33	June 17	14	15
		June 18	12	16
		June 19	2	17
		June 20	2	18
June 3	32	June 16	1	13
		June 17	3	14
		June 18	8	15
		June 19	16	16
		June 20	1	17
		June 21	1	18
		June 22	2	19
June 4	17	June 18	4	14
		June 19	7	15
		June 20	5	16
		June 21	......	....
		June 22	1	18
June 5	12	June 19	1	14
		June 20	......	....
		June 21	10	16
		June 22	......	....
		June 23	1	18
June 10	6	June 22	1	12
		June 23	4	13
		June 24	1	14
June 11	10	June 23	2	12
		June 24	5	13
		June 25	3	14
June 12	9	June 24	3	12
		June 28	6	16
June 15	11	June 28	2	13
		June 29	7	14
		July 1	2	16
June 19	3	July 3	3	14
June 23	7	July 6	7	13
June 26	1	July 9	1	13
June 27	46	July 10	44	13
		July 12	2	15
June 28	5	July 11	2	13
		July 12	3	14
July 1	1	July 12	1	11
July 7	14	July 16	1	9
		July 17	2	10
		July 18	11	11
July 8	6	July 20	6	12
July 11	12	July 23	12	12
July 12	14	July 25	13	13
		July 26	1	14
July 24	2	Aug. 4	2	11
July 26	5	Aug. 8	5	13
July 27	2	Aug. 5	2	9
Aug. 21	6	Sept. 5	6	15

Total number of eggs, 664. Weighted average for the egg period, 21.96 + days.

FERTILITY OF THE EGGS.

Not all of the eggs laid by the chinch bug are fertile. Fertility may depend upon the number of times the female has mated or upon whether or not the female has recently mated. The fact that the female lays infertile eggs at times may explain the necessity for frequent copulation, for should she mate only once or the mating interval be too great, more of the eggs might be infertile. This, however, is somewhat conjectural and further observations on this point are necessary. In one instance 40 eggs out of a total of 503, or about 8 per cent, were infertile. In another case 5 eggs out of a total of 56, or about 9 per cent, were infertile. In both instances males were with the females at all times.

NUMBER AND LENGTH OF INSTARS AND TOTAL LENGTH OF THE IMMATURE PERIOD.

According to experiments conducted at the laboratory at Columbia, S. C., in 1919, and again in 1920, the nymphs of this species molt five times during their development from egg to adult, the same number of times as do the nymphs of the squash bug (*Anasa tristis* De G.) and the harlequin cabbage bug (*Murgantia histrionica* Hahn). These species, although belonging to different families from the chinch bug, differ from this insect mainly in taxonomic characters rather than in their bionomics. There are indications that occasionally a nymph may molt only four times, as originally supposed, and very rarely six times. This, however, is the exception rather than the rule, and such variation is known to occur among larvæ of various species of lepidopterous insects.

TABLE 3.—*Number and length of instars and total length of immature period of Blissus leucopterus, Columbia, S. C., 1919–20.*

Cage No.	Nymph emerged.	Date of first molt.	Length of first instar.	Date of second molt.	Length of second instar.
			Days.		*Days.*
[1] 19–450	July 11	July 27	16	Aug. 2	6
19–454	July 11	July 27	16	July 31	4
19–459	July 16	July 27	11	July 31	4
19–462	July 9	July 18	9	July 24	6
19–463	July 10	July 19	9	July 26	7
19–466	July 10	July 27	17	July 31	4
19–468	July 10	July 20	10	July 27	7
19–473	July 16	July 27	11	Aug. 2	6
19–476	July 17	July 30	13	Aug. 4	5
19–478	July 17	July 27	10	July 31	4
19–528	July 26	Aug. 1	6	Aug. 10	9
[2] 20–700	June 11	June 29	18	July 5	6
20–736	June 15	June 29	14	July 5	6
20–747	June 15	June 29	14	July 5	6
20–748	June 15	June 29	14	July 5	6
20–751	June 12	June 28	16	July 5	7
	Average		12.75		5.75

Cage No.	Nymph emerged.	Date of third molt.	Length of third instar.	Date of fourth molt.	Length of fourth instar.	Date of fifth molt (adult).	Length of fifth instar.	Total length of immature period.
			Days.		*Days.*		*Days.*	*Days.*
[1] 19–450	July 11	Aug. 10	8	Sept. 5	26	Oct. 4	29	85
19–454	July 11	Aug. 9	9	Aug. 15	6	Sept. 5	21	56
19–459	July 16	Aug. 9	9	Aug. 19	10	Sept. 17	29	63
19–462	July 9	Aug. 2	9	Aug. 13	11	Sept. 8	26	61
19–463	July 10	Aug. 5	10	Aug. 15	10	Aug. 31	16	52
19–466	July 10	Aug. 8	8	Aug. 21	13	Sept. 20	30	72
19–468	July 10	Aug. 4	8	Aug. 21	17	Oct. 9	49	91
19–473	July 16	Aug. 9	7	Aug. 19	10	Sept. 5	17	51
19–476	July 17	Aug. 7	3	Aug. 29	22	Oct. 4	36	78
19–478	July 17	Aug. 7	7	Aug. 15	8	Sept. 16	32	61
19–528	July 26	Sept. 10	31	Oct. 1	21	Oct. 28	27	94
[2] 20–700	June 11	July 12	7	July 20	8	Aug. 3	14	53
20–736	June 15	July 17	12	Aug. 8	22	Aug. 29	21	75
20–747	June 15	July 10	5	July 26	16	Aug. 5	10	51
20–748	June 15	July 9	4	July 19	10	Aug. 11	23	57
20–751	June 12	July 12	7	July 29	17	Aug. 14	16	63
	Average.		9		14.12+		24.56+	66.43

[1] 19 refers to the year 1919.

[2] 20 refers to the year 1920.

The data obtained in connection with the experiments on the number and length of instars of 16 individuals have been summarized in Table 3. In another series of approximately equal number, under observation for about the same period as were those of 1919 given in Table 3, four molts only were observed and the nymphs were then in their penultimate stage. The length of the period of the first instar, according to Table 3, varies from a minimum of 6 to a maximum of 18 days, the second varies from 4 to 9 days, the third from 3 to 31 days, the fourth from 6 to 26 days, and the fifth from 10 to 26 days. Taking the averages obtained in the series, the period of the second instar is the shortest, the third somewhat longer than the second, the fourth slightly longer than the first, and the fifth much the longest of all. The greatest number of days required for any one of the individuals in the series to reach maturity was 94, and the smallest number 51. The general average for the total length of the immature period in the series is 66.43 days.

It is not unlikely that the length of the instars and the length of the immature period were somewhat extended, because the nymphs were kept under somewhat unnatural conditions. In this study of number and length of instars in this species small shell vials (30 mm. in length) were found the most convenient and satisfactory. These were stoppered with absorbent cotton and the cotton was moistened as often as necessary when observations were made. Small bits of cornstalks were supplied as food for the nymphs. It was necessary to be very cautious to prevent an oversupply of water from gathering on the sides of the vials. When droplets gather the nymphs, in crawling along the sides, are overcome by the water and become helpless, and if not assisted to a drier place and the vial dried out will die in a short time.

ECDYSIS.

A short time before the nymph casts its skin it becomes much swollen, especially in the abdominal region. The abdomen is then much wider than the thorax, particularly in the region of the fourth and fifth segments. Before this it is about the same width as the thorax or a little wider. The period during which the nymph has this swollen appearance will be called the molting period, and preparations are then being made by the nymph to cast off its outer cuticular layer. This period corresponds precisely to that in lepidopterous larvæ known as the molting period, during which the larvæ become sluggish, feed little or none, and prepare to shed their outer coat.

Specimens used for drawings of the various nymphal instars by C. V. Riley apparently were all in the molting stage, as the figures representing the instars show the nymphs much swollen. These drawings, therefore, are incorrect, even if the insect should have had only five stages instead of six. The specimens used for the figures in this paper all had fed for some time after casting their last molt. In most cases the specimens were preserved for three, but in some cases for only two days after molting and during this period the individual was permitted to feed. Illustrations of specimens which have just molted and have not fed, or specimens about to molt, are likely to be misleading, as they are not normal representatives of the stage desired. Very often the color pattern of a specimen fades considerably just before molting, and if drawings are made at that time the color pattern for that instar will be wrongly recorded.

The nymphs of the chinch bug during the molting period feed very little, and their color pattern fades toward the close of the period. This fading is due to the loosening of the transparent cuticular layer, which is about to be cast. The darker color pattern of the succeeding instar can often be seen through the thin layer.

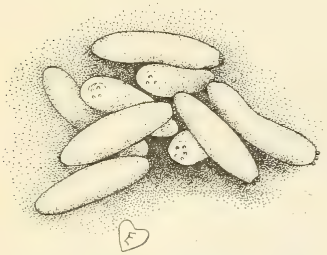

FIG. 1.—The chinch bug (*Blissus leucopterus*): Cluster of eggs, showing tubercles at the truncated or blunt ends. Greatly enlarged.

One nymph was caught in the act of casting its skin. When first observed it had already freed part of the abdomen and thorax. It then drew its legs out one at a time and by a jerky motion of the abdomen freed itself entirely from the old skin. The nymph utilized its last pair of legs to push off the skin from the tip of the abdomen.

DESCRIPTION OF THE EGG AND NYMPHAL STAGES.

A description of the egg (fig. 1) and nymphal stages is given below. It does not seem necessary to describe the adult or the sixth instar (fig. 2, *f*), but a brief discussion of the sexual differences in the adult stage is included. It seems important that the sexual differences be known in order to facilitate biological work on this insect.

EGG.

The egg is elongate ovate, slightly reniform in shape, rounded at one end and truncate at the other. The truncate end is supplied with from three to five, usually four, tubercles 0.1 millimeter in length; opaque white in color when just deposited, turning amber in a few days and deep red several days before hatching. Just prior to hatching the embryo shows through the chorion which is smooth, shiny, and somewhat iridescent.

Length, 0.858 mm.; width, 0.308 mm.

FIRST INSTAR.

FIG. 2, *a*.

Head brown; width, 0.235 mm.; eyes dark red; proboscis pale except tip which is dusky; antennal segments dusky, segment 4 of antenna about twice the length of any one of the others, points of articulation pale.

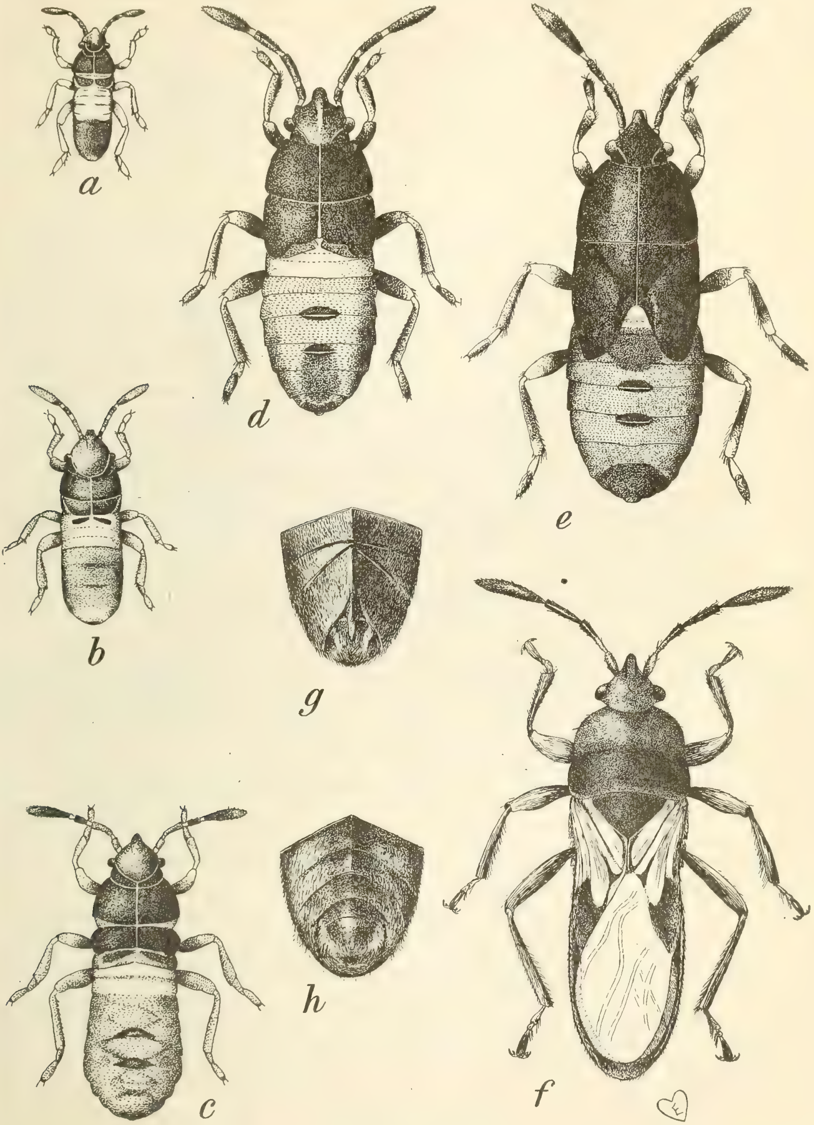

FIG. 2.—The chinch bug: *a,* Nymph, first instar; *b,* nymph, second instar; *c,* nymph, third instar; *d,* nymph, fourth instar; *e,* nymph, fifth instar; *f,* adult of long-winged form; *g,* tip of abdomen of adult female, ventral view; *h,* tip of abdomen of adult male, ventral view. Greatly enlarged.

Thorax 0.234 mm. in width; legs pale, the tarsi distinctly two-jointed; pronotum brown and coriaceous over the whole surface, 0.104 mm. in length; mesonotum pale except the small coriaceous patch on either side of the meson, which is brown, 0.062 mm. in length; metanotum pale except a narrow dark line on either side of the meson, 0.047 mm. in length. The coriaceous area on the thorax is broken on the meson and causes it to appear as though crossed by a pale line.

Abdomen about the width of the thorax, though sometimes somewhat wider, the widest part being in the region of the fourth segment. Segments 1 and 2 pale yellowish white, this color sometimes invading part of the third segment; remaining segments light red, darkening somewhat in older individuals. There is a minute, dark spot on the meson near the caudal margin of the fourth segment and a similar one on the caudal margin on the meson of the fifth segment. In some specimens these spots are absent during the first instar. Tip of abdomen black.

Length, 0.889 mm.

SECOND INSTAR.

FIG. 2, *b*.

Head brown; width, 0.314 mm.; eyes, antennæ, and beak as in first instar.

Thorax, 0.513 mm. in width; legs pale as in previous instar; pronotum resembling previous instar; mesonotum coriaceous over almost its entire surface; metanotum with two brown coriaceous patches, one on either side of the meson, resembling large exclamation points; otherwise the segment is pale.

Abdomen, 0.502 mm. in width, widest in region of fourth segment. Segments 1 and 2 pale; remaining segments darker red than in preceding instar. The dark spots on the fourth and fifth segments are somewhat larger than in the preceding instar, but have not taken on any definite shape. Tip of the abdomen black, as also the area around the anal opening.

Length, 1.287 mm.

THIRD INSTAR.

FIG. 2, *c*.

Head dark brown; width, 0.399 mm.; eyes very dark red; proboscis amber except at tip, which is almost black; segments 3 and 4 of antennæ black, 1 and 2 amber, segment 4 twice as long as 2 and 3 and over three times as long as 1; points of articulation pale, somewhat translucent.

Thorax, 0.518 mm. in width; legs amber, somewhat dusky on the femora; pronotum, mesonotum, and metanotum dark brown and coriaceous over the whole surface; wing pads discernible on the caudal border of the mesonotum near the outer edges, in the form of a slight extension or outgrowth of the coriaceous covering in this region.

Abdomen, 0.596 mm. in width, widest in region of fourth segment. Segments 1 and 2 pale whitish, remaining segments a dull red, with mottlings of a darker color here and there. The two spots on the abdomen assuming a definite shape somewhat resembling a flaxseed in outline, one spot on the caudal margin on the meson of the fourth segment and the other on the meson of the fifth segment extending partly over the suture of the fifth and six segments. Tip of abdomen black.

Length, 1.648 mm.

FOURTH INSTAR.

FIG. 2, *d*.

Head, eyes, antennæ, and proboscis the same color as in the preceding instar; width of head, 0.465 mm.

Thorax, 0.654 mm. in width; legs same in color as in preceding instar; mesonotum very narrow, only about half as long as the pronotum and only a small area of this segment visible on the meson and appearing whitish. Wing pads now conspicuous and extending about half way across the first abdominal segment.

Abdomen, 0.696 mm. in width. Segments 1 and 2 pale whitish as before, remaining segments dark red with streaks of black, giving it a blackish appearance. The black spot on the meson of the fourth abdominal segment very conspicuous. The other spot has moved farther caudad and is now found just below the suture separating the fifth from the sixth abdominal segment, or on the meson of the cephalic border of the sixth segment. Tip of abdomen black, including a small area around the anal opening.

Length, 2.114 mm.

FIFTH INSTAR.

FIG. 2, *e*.

Head black; width, 0.591 mm.; polished; eyes very dark red; proboscis amber, except tip which is black; antennal segment 1 amber, 0.157 mm. long, segment 2 amber, 0.314 mm. long, segment 3 black, 0.282 mm. long, segment 4 black, 0.518 mm. long; points of articulation pale.

Thorax, 0.937 mm. in width; legs dark; femora almost black; tibiæ light amber except tibia of third pair of legs, which is darker; tarsi dark amber; joints lighter. Pronotum, mesonotum, and metanotum black, polished. Wing pads now extending to the caudal margin of the third abdominal segment.

Abdomen, 0.957 mm. in width; widest in region of fourth segment as before. First and second segments not visible except for a small portion on the meson, remainder of these segments covered by the wing pads, whitish. Remaining segments very dark red, almost black, with a number of dark areas and blotches almost black in color, tinged with blue, iridescent. Under the unaided eye the abdomen appears black. There is a velvety area on the meson of the third segment, sometimes extending partly over the fourth segment as well. The black patch which was on meson of abdominal segment 4 in preceding stages is now on the suture separating segments 4 and 5. The other, which was on the meson of the fifth segment in the first, second, and third instars, and on the sixth abdominal in the fourth, is now on the suture separating the fifth and sixth segments. These patches are very conspicuous. The tip of the abdomen is black as well as a considerable area surrounding it; in fact, most of the abdomen caudad of the seventh segment is black.

Length, 2.967 mm.

SEXUAL DIFFERENCES AMONG ADULTS.

The male chinch bug generally is not so large and robust as the female. There are other more conspicuous characters, however, that distinguish the sexes. If the lower, ventral part of the abdomen of either sex is closely examined, it will be noted that the abdomen of the male is rounded (fig. 2, *h*), while that of the female has a distinct ridge on the ventro-meson, giving the abdomen an outline in the form of an inverted V (fig. 2, *g*). Furthermore, the tip of the abdomen in the male is rounded, and surrounding the genital opening, especially along the upper border and the sides, the area is well supplied with moderately long hairs. In the female the last segment on the ventro-meson is adjusted to shield the ovipositor and its mechanism.

A PARASITE OF THE ADULT.

From time to time collections of adults and nymphs of the chinch bug have been made in fields about Rock Hill, S. C., and brought to the laboratory at Columbia, S. C., for breeding work. No special attention was given to the possibility of rearing a parasite from the adult. A large number of adults, however, comprising a portion of the material mentioned, yielded a tachinid parasite which emerged from a male individual. The host specimen was collected by Mr. Samuel Blum on May 7. The puparium was formed on May 8 and the adult fly issued on May 20. The puparium was at first a golden color, later turning a dark red. This parasite has been determined by Mr. W. R. Walton as *Phorantha occidentis* Walk., and the determination has been verified by Dr. J. M. Aldrich of the United States National Museum.

Very little is known concerning this parasite except that it has been reared from two other hosts, both belonging to the order Hemiptera. Mr. F. B. Milliken reared an adult of this species in 1913 from an adult of the false chinch bug (*Nysius angustatus* Uhl.) and Mr. M. D. Leonard reared it from the capsid bug *Miris dolabratus* L. As far as the writer has been able to learn, this is the first record of the rearing of a dipterous parasite from the chinch bug, although a hymenopterous parasite (*Eumicrosoma benefica* Gahan) was reared by Mr. J. W. McColloch of the Kansas Agricultural Experiment Station several years ago from eggs of this species.

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